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ABSTRACT

This paper describes a technology integration curriculum created for teachers and administrators based on collaborative research in public schools; efforts to interest the Graduate School faculty at Bank Street College in integrating technology into their courses; and the benefits and disadvantages of a variety of teaching formats for students, administrators and faculty that have been used to promote the integration of technology into classrooms. The outcomes of the use of different strategies and approaches are reported, and it is concluded that classes modelling technology-supported collaborative group work are more successful with students than with faculty; that faculty members seem to need a combination of small workshops to introduce technology and consultations with technologically sophisticated curriculum experts to attempt using technology in their own courses; that despite sensitivity to gender differences in attitudes toward technology, capturing the faculty's interest in technological integration has been slow to succeed; and that the integration of technological innovation into curriculum only works well when people perceive a need for it. (Contains 5 references.) (ALF)

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CENTER FOR TECHNOLOGY IN EDUCATION

Integrating Technology into the Curriculum: Teaching the Teachers

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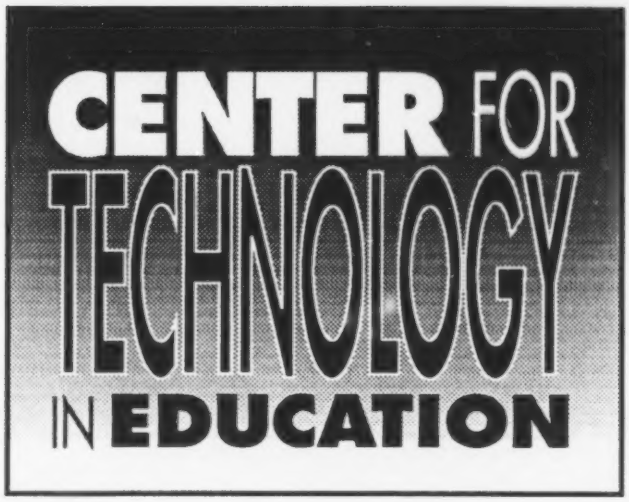

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INTEGRATING TECHNOLOGY INTO THE CURRICULUM: TEACHING THE TEACHERS

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Efforts to integrate technology into classrooms require appropriate preparation of teachers. Based on collaborative research in public schools, we created a technology integration curriculum for teachers and for administrators. To model technology integration further, we are trying to find ways to interest the Graduate School faculty at Bank Street College in integrating technology into their courses. This paper describes the benefits and disadvantages of a variety of teaching formats for students, administrators and faculty. Classes modeling technology-supported collaborative group work are more successful with students than with faculty. Faculty seem to need a combination of small workshops to introduce technology and consultations with technologically sophisticated curriculum experts to attempt using technology in their own courses.

Research About Educational Technology in Schools

The question of how to prepare teachers to integrate technology into rich, inquiry-based curricula has been on our minds at Bank Street for at least ten years. We started with research. The Center for Children and Technology was established to investigate how educational technology can best be used to support good learning and teaching environments. Most of our current school-based research is done with schools in New York, Boston, Rochester, and Providence, Rhode Island. We conduct what we call "design experiments" with these schools. Each design experiment is different, but they all have a common goal: to discover the variables that foster or obstruct the genuine integration of technology into the life of the school. We collaborate with a small group of teachers and administrators in each school to design ways to use computers and video in their classrooms. In addition to helping them think through what they might want to accomplish with technology, giving technical advice, and linking them with a variety of technology-related resources, we have ethnographic researchers on site to observe classes, to conduct interviews with teachers, administrators and students and to collect technology-supported student work for analysis on a regular basis (Collins & Hawkins, 1990).

Sometimes the policy makers whose appropriations fund this kind of research are frustrated because it does not yield clean, convincing numbers to prove that the schools' investment in computers and other technologies is cost effective. The problem, of course, is that cost effectiveness is usually measured in terms of an increase in the students' scores on standardized achievement tests. The kinds of inquiry-oriented, project-based curricula we are trying to support with technology do not automatically produce higher test

scores, even if they produce demonstrably superior thinking and learning on the part of students. Evaluation of students' progress with more complex learning activities requires new kinds of assessment tools. Creating such tools is of great concern to many educators at this point, and efforts are being made to develop them (Collins & Hawkins, 1991). Moreover, the kinds of improvements we are seeing in these design experiments are difficult to ascribe to the use of technology because the integration of technology changes how teachers teach and students learn, what work students do and how teachers assess it, how teachers relate to each other and how students work together. All these changes are supported by the use of technology, but it is not the single, distinguishable variable to which we can attribute changes in student outcomes (Brown, 1991). We have found, however, that the effort to integrate technology into the curriculum can be the catalyst that allows schools to move from discussing better ways of doing things to concrete implementations because the integrated use of technology requires a change in pedagogy.

Technology Education

The Graduate Students

Investigating how best to prepare education students for the complex task of integrating technology was part of our research agenda. Bank Street had a specialization program in which graduate students could obtain certificates or master's degrees in Computers in Education. Logo was a major focus of that program some years ago. Our school-based research convinced us that it would make more sense to concentrate on integrating computers into content curricula than on teaching programming or computer literacy courses to graduate students. To achieve such integration, we developed a series of experimental technology courses intended for general education students as well as for technology specialists.

The experimental courses were intended to model project-based, inquiry-oriented, technology-supported learning and teaching. An introductory course was designed to give students an overview of the kinds of multimedia technologies available today, and to develop a vision of creative usage of such technologies in the classroom. Students learned to use basic software tools, such as word processors, databases, spreadsheets, and graphics programs, as well as peripherals such as scanners and digitizers. Each class consisted of a mixture of discussion of educational issues raised by the technology and hands-on work with several of the computer tools to create, as a course project, a piece of computer-supported curriculum material.

We also offered a course in HyperCard, which can be used to create sophisticated multimedia presentations without learning to think like a programmer. Powerful graphic tools, fancy visual effects, sound and video capacities, and hypertext linking are all built in. The course is taught as a studio class. Students are not responsible for demonstrating knowledge of the programming language, but rather for handing in a useful, finished interactive project and documentation to describe its purpose, explain its design, and discuss its implications for education. The instructors function as consultants. Students acquire programming knowledge when the need for it arises in relation to their project rather than as a part of a systematic exposition of the major features of the language. The students are learning how to create educational software tools or materials rather than a programming language.

A third course was designed to model technology-supported collaborative group work. The entire group of students created a piece of curriculum. The group as a whole chose a topic and decided what aspects to research, how to frame the presentation, and how to make it interactive enough to allow for genuine exploration by 10-year-olds. Once the overall structure was decided, individuals and small groups did much of their research and production work independently. Students collected information and then scanned, typed, drew, and composed it into a series of HyperCard stacks. Individuals contributed stacks about a specific subtopic. As a group, they decided how to link the individual pieces together. Part of the class time was set aside for discussion of the implications of this way of working. The instructors planned to spend several weeks at the end of the semester testing the finished product with children and embedding it in other, nonelectronic curriculum materials and activities. As is the case with most complex production efforts, everything took longer than anticipated. Students got so involved in creating information, they had little time left to discuss it. At the end, even without sufficient time to reflect and absorb, students generally agreed that they had learned more about the content of their research by creating this computer

presentation than they would have by writing a paper about it. Finding the right image to illustrate an important point or the right way of phrasing an important piece of information seems much more complex when the choice of how to explore the material is up to the audience rather than the author. The interactive nature of the presentation brought these issues into critical focus. Students in the course agreed that their own students would benefit greatly from having the opportunity to work in this way.

The Administrators

The problem with the learning and teaching processes we model in these courses is that few schools are set up to permit that kind of intensive, long-term project work. Limited class time and access to technology often mitigate against technology-supported discovery learning. As a result, we are attempting to attack the problem of technology integration from another direction. Our research indicates that the intelligent support of administrators is critical to the success of technology integration in schools. Administrators must not only agree that technology should be integrated into the curriculum, they must also understand the wide-ranging implications of such integration for the life of the school. They must know that the investment in technology cannot be expected to pay off in immediate gains in standardized test scores and, even more important, they must be prepared to support and guide teachers who experiment with technology integration. They must understand how long it takes even master teachers to become so comfortable with a new technology that they can be as creative and flexible with it as they are with paper or chalk. Our research suggests that it takes an average of five years before teachers really feel in command of the technology and know how to use it, when to use it, how to assess its benefits, and how to evaluate any new technology's usefulness for their curriculum (Sheingold & Hadley, 1990).

The emphasis on project-centered collaborative work can create a good deal of transitional upheaval in a school. Administrators have to be prepared to countenance and direct some of that disruption. The schedule and program of the school often have to be revised as the participating teachers realize the need for greater flexibility. Since mandating technology integration from above does not work, administrators have to find ways to showcase and support the efforts of participating teachers in order to convince others to give it a try. As more teachers become involved with technology, there are more requests for additional software and hardware. The growing inventory has to be managed. There is never enough technology. Administrators have to help solve scheduling conflicts without retreating to the establishment of a separate technology laboratory with its own tightly controlled class schedule. Few computer coordinators, assuming a school is lucky enough to have one, are prepared to deal with the conflicting demands of teachers who want to do project-based collaborative work supported by technology. Their primary concern is to keep the technology in good shape. This often conflicts with the teachers' need to experiment with different hardware configurations and software applications.

To introduce administrators to this complex way of using technology, we are teaching a course that is designed to support the other courses the administrators are taking in the program. We planned the course with the participating faculty. We are teaching computer applications that are directly related to the content of their courses. When the participating administrators are learning about budgets, for instance, we teach them how to use a spreadsheet. When they are learning about ways to interest and involve parents and the community in their school's program, we teach them how to use graphics and presentation programs to create the kinds of stimulating presentations the business community has been using for years. In addition to acquainting them with these software tools and with the software systems used to manage school data, we discuss our research findings to prepare them to support teachers' use of technology in the classroom. The technology course runs parallel to the other courses for the entire year, including the summer semester. Other instructors in the program require that the administration students hand in technology-supported work. For example, a hypothetical budget for a school has to be a print-out from a spreadsheet rather than a hand-typed report.

The Faculty

Right now, the technology education program at Bank Street is in transition. Rather than attempting to teach integration of technology into the curriculum, we are presently trying to model it. We decided that the existence of a separate technology integration

course was sending a contradictory message to our students. Our research focus has thus shifted to a concern with how to help the faculty to integrate technology into their curriculum. We expect that students will increasingly come to graduate schools having learned to use computers in high school and college and will thus need no more than a minicourse to acquaint them with the particular technology resources available in a given institution. We also believe that multimedia presentations will become as commonplace as research papers, and that computer programs, video, and other technologies will become obvious resources used in all curriculum designs. Graduate School faculty will consequently have to learn to integrate technology into their own classes if they are to continue to model good teaching and learning environments.

The main challenge to this vision of technology use is, at present, the faculty's ability to model technology integration. To put the horse back in front of the cart, we have decided to use our limited staff resources to concentrate on teaching the faculty rather than the students. Faculty members have neither the time nor the inclination to commit to a full course. We are thus trying a combination of seminars, workshops, and consultant arrangements to interest at least a core group of faculty in modeling technology integration for the rest of their colleagues. Based on the model of our design experiments, we are hoping to recruit a few interested faculty members to design and foster a technology culture in the institution that allows the students of those few to lead the rest of the faculty into joining it. We imagine students presenting faculty members who are technology novices with multimedia reports instead of traditional papers or referring to technology in curriculum designs done as course projects, thus requiring their teachers to educate themselves sufficiently to evaluate such student productions.

When we announced a faculty seminar, held once a month or every three weeks, in which we would help attending faculty think about ways in which they could use technology in their courses, many expressed an interest in attending. Scheduling the seminars has been a major problem, however, because only a small fraction of those who wish to attend are available at any given time. When we meet, the participants fall into two distinct categories: those who are familiar with computers and would like to learn about newer technologies, and those whose knowledge is very limited but who recognize that they cannot ignore technology forever. In a class of graduate students, this division presents absolutely no problem. The beginners feel no embarrassment at being novices and the more advanced students consider it normal to help their less knowledgeable peers. The novices are interested in knowing something about the possibilities of the technology, even if they are not yet ready to take full advantage of them, and the more advanced students consider the help they give their novice peers good teaching experience. This model is more problematic with Graduate School faculty. It seems harder for them to accept the role of learner. The faculty novices often seem more intent on justifying their lack of knowledge by questioning the benefit of technology than they do in learning about it. The technologically advanced faculty often seem more interested in technology one-upmanship than in helping their peers. For both groups, a nice, juicy, philosophical debate of the merits and implications of technology in various contexts seems preferable to a concrete lesson. Many faculty members seem to feel that their particular style of learning and teaching should not only be respected but should form the basis for instruction. Faculty often find it extremely difficult to accept a nonexpert role, even for a short period.

The faculty seminar is in its first experimental year. The original plan was to take one faculty member's curriculum in each session and find a way to integrate technology into it. The specific computer skills needed to implement that plan could then be acquired by the faculty member by taking a workshop or minicourse. Since we phased out the Computers in Education program, those faculty are now free to consult with individual colleagues on specific ways to implement a technology-supported curriculum design. We learned from our research that one-to-one consultations with a technology expert who is also a teacher and thus understands curriculum issues are critical to creative technology usage. The technology consultants can help the teacher-clients to think through the relationship between a curriculum goal and a technology-supported activity, anticipate and plan for logistical and technical bottlenecks, evaluate and revise the plan after it has been put into practice, and can support and console them when the inevitable technical snafus disrupt a well-planned class.

The problem with this model is that it requires

that the participating faculty be willing to spend the time to learn enough about the technology they plan to use to benefit from such consultations. Some faculty members expect to use the consultants the way they have used the audiovisual department, that is, to appear in class and "run" the technology for them. They are not interested in letting the way they use technology alter the way they teach. They understand the theoretical relationship between creative technology use and new ways of teaching, but since they teach about these new ways of teaching, they often feel that this relationship does not apply in their case. It is our hope that, by giving them the opportunity to consult with their peers on the faculty rather than with "outside" technology experts, this problem might be minimized. But genuine collaboration with their peers, opening up their classroom by allowing another teacher to see exactly how they teach, is no easier for Graduate School faculty than it has been for public school teachers in our design experiments.

The original plan of taking a specific curriculum and designing a technology integration for it may not work. Even though there are faculty members who are willing to "expose" their teaching content sufficiently, others often have a hard time accepting that such focus on a particular curriculum could be relevant to their own teaching. Again, the model works better with students, who are used to taking relevant aspects of a lesson and applying them to their own work. As a result, we have started to turn the faculty seminar into a series of workshops, each designed to give any interested faculty a demonstration of and some hands-on practice with a particular technology. The first of these workshops was on graphics. We set up scanners and digitizers in the resource room. We demonstrated how to scan a magazine picture, capture a live video image, and taped sound as well as live sound. We also demonstrated the kinds of graphics programs available to manipulate and retouch the captured images, and the ways in which text, images, and sound can be combined into a hypertext-based multimedia document.

As with all presentation to the faculty, theoretical discussion precedes and often takes the place of hands-on practice. Students are more likely to want to acquire new knowledge and then to think about the implications of these new ideas and practices for their own pedagogy. Faculty are more inclined to discuss the theoretical implications than to fumble with new skills. They often walk away from a demonstration expressing great interest in the technology, but still expecting someone other than themselves to actually *use* it. There are always some who promise to take the time to learn later, when they need it. This makes sense in theory. In practice, the need rarely arises and when it does, the faculty usually underestimate the amount of time required to practice using a new technology before it becomes a genuine convenience. Our plan, therefore, has changed once again. For the remainder of this first year of trying to teach technology integration to the faculty, we will be holding a series of "clinics" in the computer resource room. Faculty will be notified each time and invited to come and bring their specific technology needs or interests. Center staff and faculty consultants will be available to demonstrate any technical process to individuals or small groups. At the end of the year, we will evaluate the results of all our efforts and redesign the campaign to integrate technology into Bank Street's Graduate School.

Conclusion

A few years ago, we completed a study on gender and technology, in which we interviewed technology experts, women and men, about their relationship to technology. We found important gender differences both in the way women and men come to learn about new technologies, in the aspects of technologies that interest them, and in the way they feel about the technology they know best (Brunner, 1990). The ways in which we describe and present technology are based on insights gained from that research. Since many members of our faculty are women, these considerations are particularly important. We are careful to avoid unnecessary "tech-talk." We demystify technology. We do not expect faculty to be interested in the machine for its own sake or to be impressed by its power to do things faster or more efficiently. We present technology as an expressive and creative medium. Nevertheless, our efforts to capture the faculty's interest have been slow to succeed. There is still a certain dislike of technology among some faculty members, a suspicion that hi-tech solutions to educational problems can lead to a loss of perspective, that the technology can end up driving the curriculum rather than the needs

and interests of the students. These concerns are legitimate, but they are not the reason for the relative lack of success in our faculty-education efforts. Nothing in our approach conflicts with the curriculum ideas of participating faculty. On the contrary, we find ways to support and enhance the kinds of teaching and learning practices the faculty member wants to foster.

The reason may be that innovation only works well when people perceive a need for it. Bank Street faculty, with some notable exceptions, do not yet perceive a genuine need to integrate technology into their curricula. The changes we have seen in schools were the result of the willingness of a few teachers to try something new and to demand a change in the system to accomplish their goals. The motive for this effort often came from a belief that something more had to be done for the students, that the educational system was not adequate, that children were not being prepared for the modern world. Reform and restructuring can be both the impetus for and the result of the integration of technology into the curriculum. These preconditions may not exist in the same way in a private, progressive graduate school of education. Bank Street faculty do not feel they short-change their students, nor are the students dissatisfied with the education they get. There is no immediately apparent need to change anything. As more students enter a school system that requires them to be technology literate, faculty may feel the need to prepare them better. But how can we expect the school system to change if we don't prepare teachers to demand more from it? And how can we expect teachers to create learning environments that differ radically from the ones in which they were educated? We do know that mandating innovation does not work. Our best strategy, at this point, is to find and nurture small groups of faculty, give them the opportunity to integrate technology into their curricula, and hope that their success will inspire others to give it a try. ■

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